Section 5.2 HOT SOAK EMISSIONS

5.2.1 Introduction

Hot soak emissions are comprised of fuel vapors emitted from a vehicle after the engine is turned off. The elevated engine temperature causes fuel vaporization from different sources such as fuel delivery lines, purge line to the canister, and gas cap. For carbureted (CARB) vehicles, the residual fuel in the carburetor bowl and intake manifold can vaporize and escape the evaporative control system. For vehicles with fuel injectors (FI), residual fuel may drip from the fuel injectors. In addition, external factors such as the ambient temperature and fuel Reid vapor pressure (RVP) also effect the rate of hot soak emissions.

The hot soak emission factors in MVEI7g1.0c were developed in 1992 using data from ARB's past vehicle surveillance programs, where vehicles were selected randomly for hot soak emissions testing. To refine the hot soak emission factors, it is imperative to update the methodology with the most current data. In particular, the introduction of enhanced evaporative testing and reformulated gasoline as well as improved evaporative emissions control technology may all contribute to lower evaporative emissions from new vehicles. Table 5.2-1 presents the changes in evaporative emission standards through the years.

Table 5.2-1. Evaporative Vehicle Emission Standards

Model Years	Standard (hot soak + diurnal)	Test Procedure
1972-1977	2 grams/test	Carbon Trap
1978-1979	6 grams/test	SHED
1980-1994	2 grams/test	SHED
1995 and beyond	2 grams/test	Enhanced Evap. Test
2004 and beyond	0.5 grams/test	Enhanced Evap. Test

Research on hot soak emissions is ongoing and several major studies have been conducted in the past few years. The data used in this analysis are from hot soak emission studies conducted by ARB, U.S. EPA, and the Auto/Oil study. It is anticipated that with updated data, a refined hot soak emission model can be developed.

5.2.2 Objectives

This analysis intends to achieve the following tasks:

1. Develop the emission profile based on minute-by-minute hot soak data.
2. Develop a new "cut-off" point for hot soak emissions and relate the one-hour conventional hot soak emissions to the newly defined hot soak interval.
3. Develop hot soak basic emission rates.
4. Develop emission regime growth rates.
5. Assess the impact of I/M and OBD II on hot soak emissions.

5.2.3 Methodology

The hot soak data analyzed in this study come from four databases: ARB's In-Use Vehicle Surveillance Projects conducted from 1976 to 1994, Auto/Oil Air Quality Improvement Research Program conducted in 1993, EPA's hot soak emissions test program conducted in 1995, and CRC E41. Prior to analysis, all data were separated into three categories; namely, normal, moderate, and liquid leakers. The cutpoint for normal and moderate emitters was established at 2 g/test and 1 g/test, for carbureted and fuel-injected vehicles respectively. A high liquid leaker is defined as a vehicle with a fuel leak and is identified from either the EPA or Auto/Oil inspection report. The average hot soak emissions are approximately 21 g/test from those vehicles leaking fuel.

Table 5.2-2 lists the distribution of model years with respect to emitter category from the three databases. As expected, there are more vehicles in the normal emitter category when compared to high emitters. The model years range from 1969 to 1997.

Table 5.2-2 Model year distributions of vehicles from four databases

	ARB		AUTO/OIL		EPA		CRC		
MY	CARB	FI	CARB	FI	FI	CARB	CARB	FI	Subtotal
69	1								1
70	17								17
71	27								27
72	27	1							28
73	25								25
74	31	1							32
75	75	2							77
76	91	4							95
77	58	4							62
78	129	7							136
79	107	17							124
80	132	19							151
81	109	18			4	1			132
82	98	13			4	1			116
83	67	23	12	4	6	2			114
84	56	32	17	8	4	2			119
85	30	32	4	18	5	4			93
86	19	20	11	22	9	12			93
87	12	12	7	32	10	15			88
88	5	15	6	29	2	13			70
89		11	4	22	3	19			59
90		6	0	34		16			56
91		4	1	35		21			61
92		3		26		10		13	52
93				4		4		12	20
94						10	1	12	23
95						1		4	5
96								6	6
97								2	2
								Total	1884

Though not all tests were performed under the same ambient temperature conditions and fuel RVP, all data were adjusted to 9 RVP and 75 F using fuel and temperature correction factors developed in section 5.2.4.

Figure 5.2-1 briefly outlines the methodology employed in this study. Prior to developing the hot soak emission factors, emissions profiles for normal, moderate, and liquid leakers were generated based on “real-time” modal data analysis. (See Appendix 5.2-A1 for detailed information on modal data analysis.) As a result, hot soak emissions were defined to end after 35 minutes. Consequently, the conventional one-hour hot soak data were adjusted to 35 minutes. The data were then stratified into model year and technology groupings prior to developing the hot soak basic emission rates.

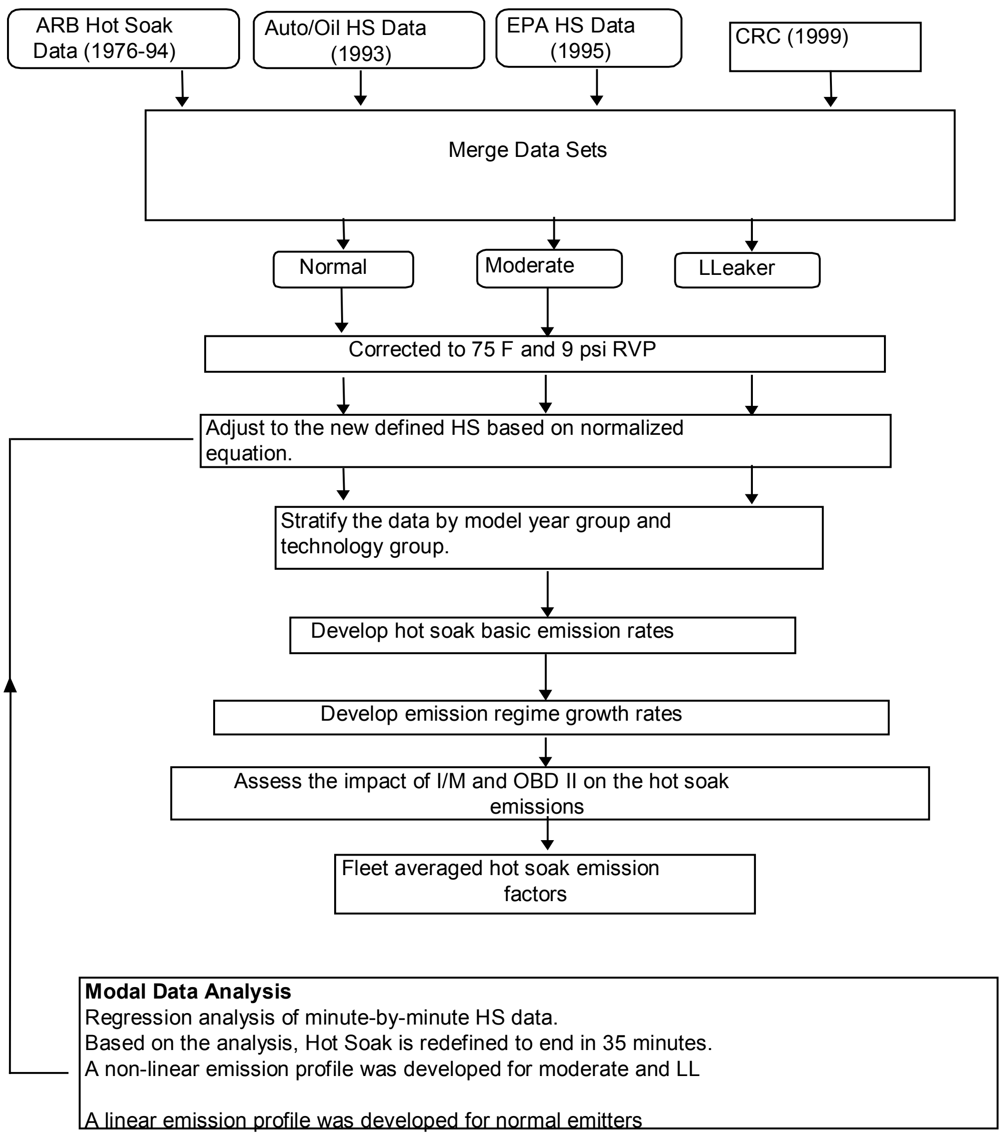


Figure 5.2-1. Flowchart of the methodology used for hot soak data analysis

5.2.4 Temperature and RVP Adjustments

In order to develop Temperature and RVP adjustment factors, 337 vehicle-temp-RVP test combinations were analyzed. These data are from USEPA testing primarily in Phoenix and South Bend. The complete data set is available in Appendix X-A2.

Table 5.2-3 gives the resulting equations and coefficients.

Table 5.2-3 Temperature and Fuel Correction Equations

FUELSYS	MYGROUP	INTERCEPT	NRVP	NTEMP
CARB	ALL	2.337071	0.241183	0.0239
FI	ALL	-0.480003	0.355518	0.063063

HS = exp(Intercept + NRVP*(RVP-9) + NTEMP*(T-75))

To become a true correction factor:

TEMP/RVPcf = HS(T, RVP)/HS(75, 9) =

[exp(Intercept + NRVP*(RVP-9) + NTEMP*(T-75))]/[exp(Intercept)] (5.2-1)

Insufficient data were available to segregate temperature and RVP effects by regime or model year. However, differences were observed for fuel delivery system.

5.2.5 Development of Hot Soak Basic Emission Rate (BER)

After adjusting the data to 9 RVP and 75 F, and further correcting to 35 minutes, the data were grouped by technology into CARB and FI (combining throttle-body injected and multi-port fuel-injected vehicles). The data were then stratified into the appropriate emission regimes, technology and model year groups. A normal carbureted vehicle was defined as being less than 2 grams/test. Normal fuel-injected vehicles were defined as less than 1 gram/test. A linear model was used to relate hot soak emissions to the age of the vehicle and is defined in the following equation:

Hot soak = α(age) + Intercept (5.2-2)

Age = CY - MY + 1 (5.2-3)

where CY = calendar year when the testing was conducted.
MY = model year of the vehicle.

Because of the uneven distribution of sample sizes, regression analyses were repeated by combining certain model year groups to obtain more meaningful and robust results. Since the data exhibit high variability, even the linear model may not depict the relationship adequately. Instead, average hot soak emission rates were used. Vehicles identified as liquid leakers were segregated from the moderate vehicles.

Table 5.2-4 lists the results of the analysis. As expected, emissions in the moderate emitter regime could be an order of magnitude higher than those in the normal emitter regime. The Age term was found not to be significantly different from zero. However, the model was programmed a linear function in case this changes with additional data. Because these technology groups are not exactly the same as the technology groups used in other aspects of the model, these technology groups are mapped to those of Appendix B.

Table 5.2-4 Hot Soak Basic Emission Rates at 75 F and 9 psi (g/35 minutes)

CARB

Status	Model Year Gp	n	Intercept	Age	Tech Group
	Pre77	158	0.746	0.000	1-3, 21-23
Normal	1977 +	469	0.531	0.000	4, 24
	Pre77	453	6.674	0.000	1-3, 21-23
Moderate	1977 +	188	6.305	0.000	4, 24
LL	All	19	21.340	0.000	1-4, 23-24

FI

Status	Model Year Gp	n	Intercept	Age	Tech Group
	Pre79	41	0.322	0.000	5. 6, 25, 26
Normal	79 - 85	150	0.209	0.000	7, 8, 26, 27
	86+	240	0.129	0.000	9,10,29,30 11,12,31,32
	Enhanced	6	0.038	0.000	13, 33
	Near Zero		0.010	0.000	14, 34
	Pre79	28	4.827	0.000	5. 6, 25, 26
Moderate	79 - 85	23	2.561	0.000	7, 8, 27
	86+	41	2.561	0.000	9,10,29,30 11,12,31,32
	Enhanced		0.761	0.000	13, 33
	Near Zero		0.199	0.000	14, 34
LL	All	See CARB	21.340	0.000	4-13, 24-33

5.2.6 Estimation of Basic Emission Rate for Near-zero Evap Vehicles

The basic emission rates for near-zero evap vehicles were estimated from the basic emission rates of enhanced evap vehicles. The BER of passenger cars were determined by taking the BER of enhanced evap vehicles and ratioing by the standards (2 grams and 0.5 grams respectively). The BER for other vehicle classes was determined by applying the ratio of the standards to the BER of passenger vehicles (PC) as outlined below. These ratios are applied to Normal and Moderate emitters only.

Class Specific Scaling Factor

Class	Tech	Near-zero Evap Standards	Scalar (Ratio of Standards)
PC	Near-zero Evap	0.5	1
T1	Near-zero Evap	0.65	1.3
T2	Near-zero Evap	0.9	1.8
T3	Near-zero Evap	1	2
T4	Near-zero Evap	1	2
T5	Near-zero Evap	1	2
T6	Near-zero Evap	1	2
T7	Near-zero Evap	1	2
T8	Near-zero Evap	1	2

Phase-in Schedule

Near-zero evap vehicles are phased in as follows:

MY	% Near-zero Evap
2004	40
2005	80
2006	100

5.2.7 Development of Emission Regime Growth Rate

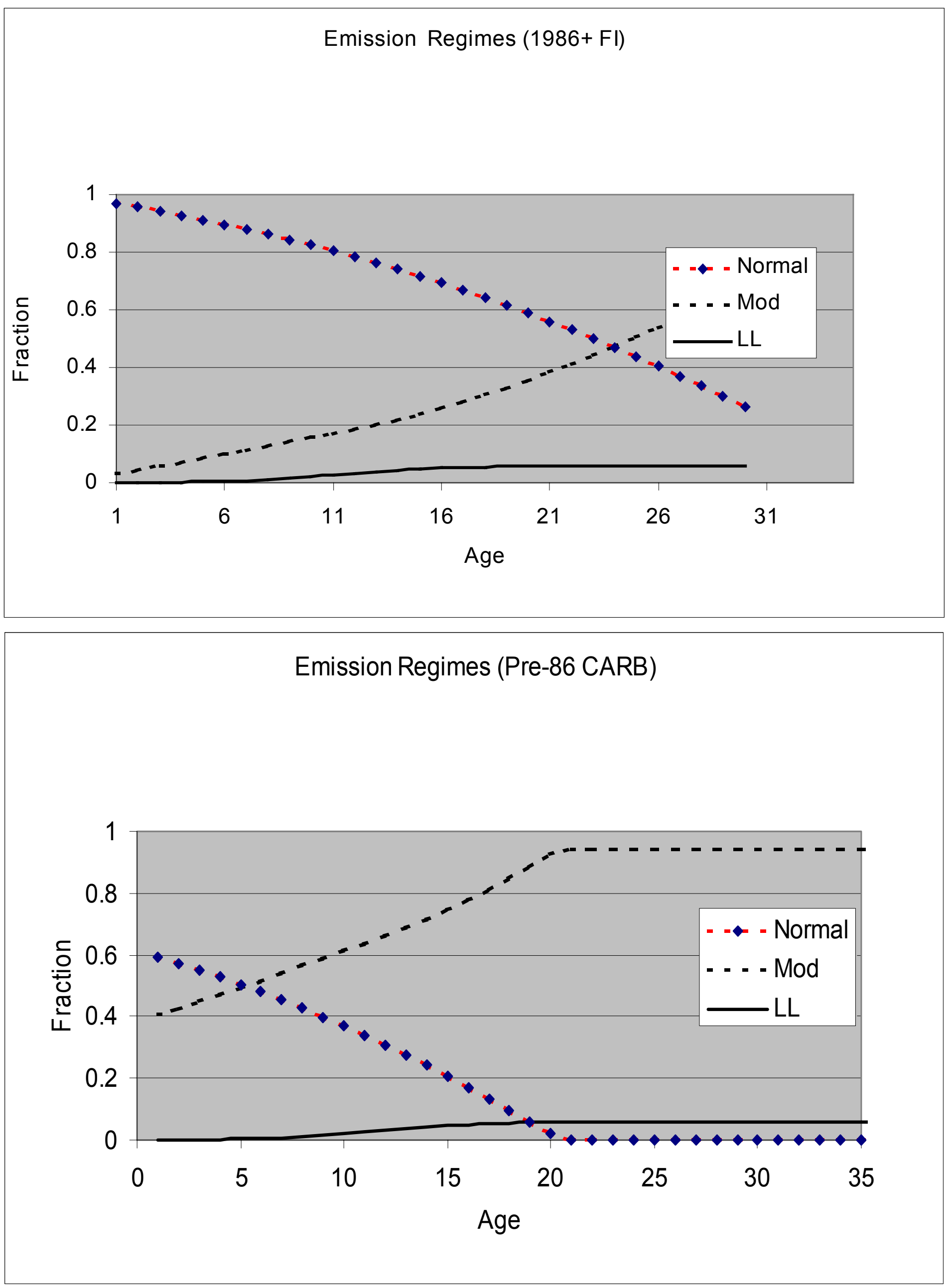
The emission regime growth rates were developed to estimate the overall emissions from vehicles per year, as the emission status of vehicles may change with respect to age. Normal and moderate emitter growth rates for CARB and FI were estimated using those cutpoints defined earlier. The following is the linear model relating growth rate to age.

$$\text{Emission regime growth rate \%} = \alpha(\text{age}) + \text{Intercept} \qquad (5.2\text{-}4)$$

The regression is weighted by sample size for each age because of the uneven distribution of vehicles by age. On the other hand, the emission regime growth rate for high emitters was estimated based on EPA's assessment of liquid leakers. For reasons of consistency, it was assumed that the same liquid leaker growth rate be applicable to all technology groups for all evaporative processes.

Figure 5.2-2 presents the emission regime growth rates for 1986+ FI and pre-1986 CARB. As expected, as age progresses, more FI vehicles remain in the normal regime when compared to CARB. In the event the sum of fractions of moderate and high emitters exceed 100%, moderate and high regime growth rates are adjusted by normalizing their sum. The regime growth rates equations are summarized in Table 5.2-4.

Figure 5.2-2 Emission Regime Growth Rates



Liquid Leaker Fraction
The fraction of Liquid Leakers (LLfr) is defined in Section 5.1

Moderate Fraction
The Moderate fraction (MODfr) is defined as

MODfr = Intercept + a*Age+b*Age^2 (5.2-5)

Table 5.2-5a

FI

MYGROUP	Intercept	Age	Age^2	R Square	Tech Group
Pre86	0.1476	-0.0252	0.00302	0.5537	5-8, 25-28
86+	0.02048	0.01123	0.00042	0.5134	9-12, 29-32
OBDII	-0.05803	0.00535	0.00042		13, 14, 33, 34

Where OBDII is discussed in section 5.2.9

CARB

MYGROUP	Intercept	Age	Age2	R Square	Tech Group
Pre77	0.38645	0.0192	0.00053	0.8129	1-3, 21-22
77+	0.19822	-0.0104	0.00165	0.1035	4, 23-24

Normal Fraction

Table 5.2-5b

FI

MYGROUP	Intercept	Age	Age^2	R Square	Tech Group
Pre86	1.024448	-0.02953	0.0	0.344	5-8, 25-28
86+	0.993933	-0.01526	0.0	0.593	9-12, 29-32
OBDII	0.993933	-0.01526	0.0		13, 14, 33, 34

Where OBDII is discussed in section 5.2.9

CARB

MYGROUP	Intercept	Age	Age2	R Square	Tech Group
Pre77	0.645285	-0.02903	0.0	0.884	1-3, 21-22
77+	0.857149	-0.00957	0.0	0.073	4, 23-24

It is possible for the regimes to sum to more than 100%. If this occurs, a normalization process is employed to assure the sum adds to 100%.

5.2.8 Estimation of I/M corrected Hot Soak Emission Factors

The average emission factor for normal emitters with respect to age is defined as follows:

Average EF for Normal Emitters in the Fleet ($EF_{\text{Ave Normal Emitters, Age}}$)
= Normal Emitter Rate $_{CARB}$ *EF $_{CARB}$*CARB Vehicle Fraction +
Normal Emitter Rate $_{FI}$*EF $_{FI}$*FI Vehicle Fraction (5.2-6)

Similarly, the average emission factor for moderate and high emitters with respect to age is defined as follows:

Average EF for Moderate Emitters in the Fleet ($EF_{\text{Ave Moderate Emitters, Age}}$)
= Moderate Emitter Rate $_{CARB}$ *EF $_{CARB}$*CARB Vehicle Fraction +
Moderate Emitter Rate $_{FI}$*EF $_{FI}$*FI Vehicle Fraction (5.2-7)

Average EF for High Emitters in the Fleet ($EF_{\text{Ave High Emitters, Age}}$)
= High Emitter Rate $_{CARB}$ *EF $_{CARB}$*CARB Vehicle Fraction +
High Emitter Rate $_{FI}$*EF $_{FI}$*FI Vehicle Fraction (5.2-8)

Because of the I/M program, vehicles undergo smog check inspection biennially. Hence, we assume moderate emitters will receive I/M benefit as some of the components causing high hot soak emissions are identified and repaired. In particular, it is assumed that vehicles identified and successfully repaired will change their status from moderate to normal emitters. Therefore, the moderate emitter rate for CARB and FI would be adjusted accordingly.

Though there are many malfunctioning emission control components that could lead to excessive hot soak emissions, only gas cap checks are performed in I/M. Therefore, gas cap failure rates were used to estimate I/M benefits. Note that the data for gas cap failure rates are based on smog check testing conducted by the Bureau of Automotive Repair (BAR) in 1996. Appendix 5.2-4 lists the methodology for estimating gas cap failure rate.

Fraction of vehicles changed from moderate to normal emitters per inspection period ($\text{Rate}_{\text{Moderate to Normal}}$).
= Identification Rate (ID %)*Incremental Gas Cap Failure Rate (IGC Fail)*Repair Efficiency (Repair %) (5.2-9)

Thus, adjusted moderate emitter growth rate for both CARB and FI per inspection period is as follows:
= Moderate Emitter Growth Rate - $\text{Rate}_{\text{Moderate to Normal}}$
(5.2-10)

Assuming the identification rate and repair efficiency is 95%, and that the vehicle stays in the normal regime, the new moderate emitter growth rate is thus given as follows:

New Moderate Emitter Growth Rate = Moderate Emitter Growth Rate * (1-0.95* gas cap failure rate)

5.2.9 Moderate Emitter Growth Rate and OBD II

Emissions control components are closely monitored by the OBD II system and are likely to be repaired once malfunctioning components are detected. Therefore, the hot soak emissions of OBD II equipped vehicles will be modeled by suppressing the formation of moderate emitters for the first seven years of a vehicle's life. As a result, the new moderate emitter growth rate for OBD II vehicles will be corrected accordingly by subtracting the fraction of moderate emitters for the first seven years. As under I/M, it is assumed that OBDII will not detect Liquid Leakers.

To suppress the formation of moderates for the first 7 years, equation 5.2-5 is modified to:

$$Mfr = Intercept + a*(Age-7)+b*(Age-7)^2 = 0$$

And the coefficients are re-calculated.

It was assumed that the regime growth rate for the Liquid Leakers would remain unchanged. Therefore, the fraction of normal emitters is given as follows:

Fraction of Normal Emitters = 1 – Adjusted Fraction of Moderate Emitters – Fraction of Liquid Leakers

5.2.10 Partial Hot Soaks

Figure 5.2-A3 of Appendix 5.2-A1 is to be used to estimate the partial hot soak emissions for vehicles that do not complete the full 35 minute soak. Additionally, a certain fraction of the fleet take trips too short for the fuel temperature to reach levels necessary for hot soak emissions to occur. Staff believes this time is approximately 4 minutes, which is consistent with MOBILE6 ("Soak Length Activity Factors for Hot Soak Emissions", Report Number M6.FLT.004)

5.2.11 Conclusions

While this analysis represents a more up-to-date approach to modeling hot soak emissions, more data are needed to reflect the changes in the current evaporative emissions regulations. Note that in the previous hot soak analysis for MVEI7G, the definition of conforming and malperforming is based on the failure of emission control components. However, the current methodology stratifies the data into normal, moderate and high emitter categories based on cutpoints.

It is recommended that future evaporative studies put more emphasis on the design of the experimental methodology so that meaningful data will be collected to facilitate the analysis. Particularly, there is a need for hot soak emission data for newer model year vehicles. As the technology is changing, it is expected the projected hot soak emissions will decline as more advanced emission technology is introduced in future.

Appendix 5.2-A1 Modal Data Analysis

Previously, hot soaks were defined as lasting one hour because of the duration of the test. However, evidence has shown that hot soak emissions may end before one hour. In ARB's research project 2S95C1, minute-by-minute modal data were collected for 12 vehicles. As shown in Figure 5.2-A1, there are two distinctive trends of emission profiles. The first group is the normal emitters where emission rates remain almost constant throughout the entire hour. The second group is the moderate and high emitters where the hot soak emission rate tends to increase rapidly in the beginning and reach a plateau before the end of the one-hour test. Therefore, it is plausible to assume normal emitters exhibit a linear emission profile while the moderate and high emitters exhibit a non-linear emissions profile.

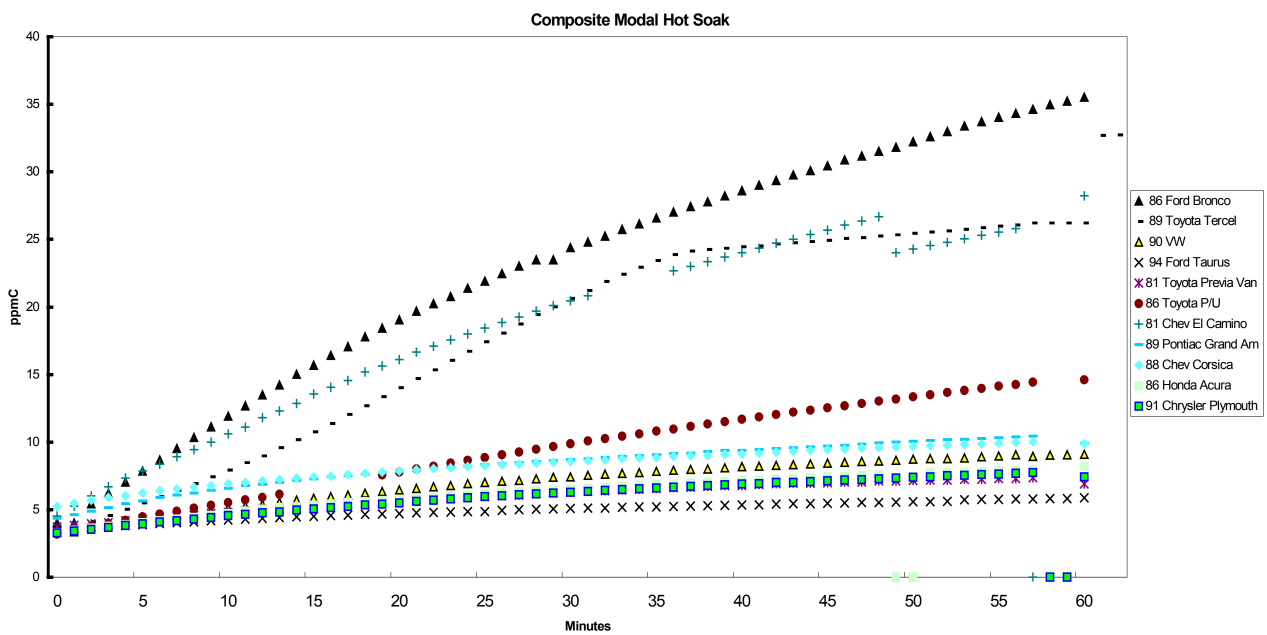


Figure 5.2-A2 presents both the linear and non-linear emission profiles normalized to 60 minutes. From a visual examination of the raw data, it was determined that hot soak emissions reach a plateau around 35 minutes. In other words, hot soak is redefined to end at 35 minutes. Because of this new definition, all of the historical hot soak data were adjusted to 35 minutes. As shown in Figure 5.2-A2, the newly defined hot soak for a normal emitter is 58% of the historical one-hour hot soak emissions while moderate and high emitters are 83% of the historical one-hour hot

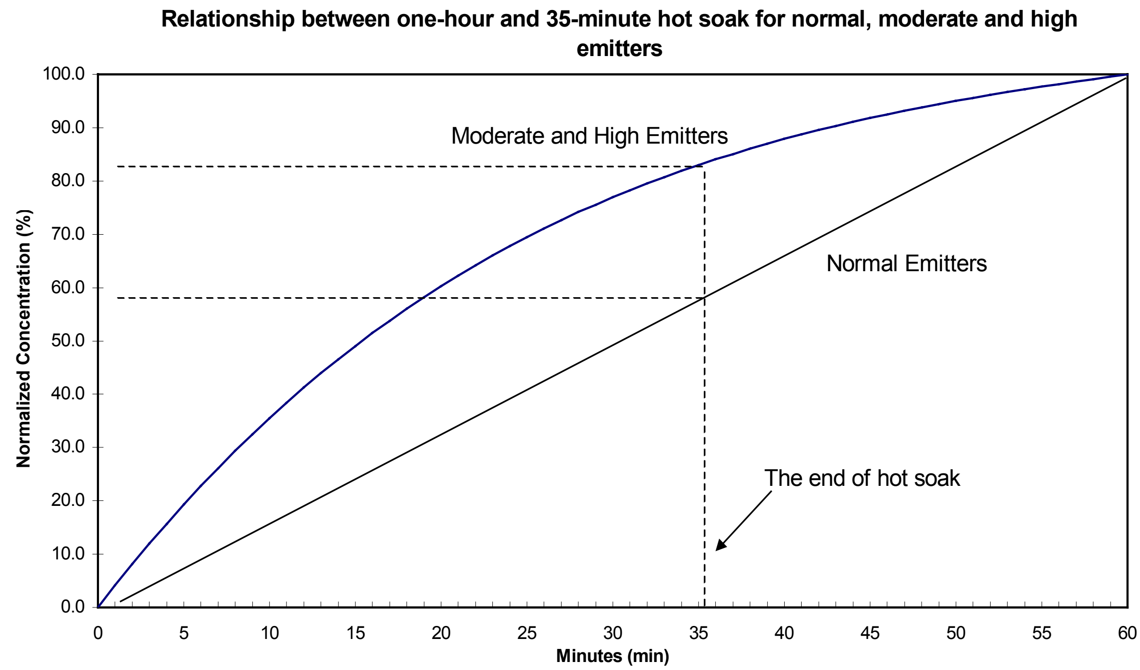


Figure 5.2-A2. New defined hot soak based on normalized one-hour hot soak profiles

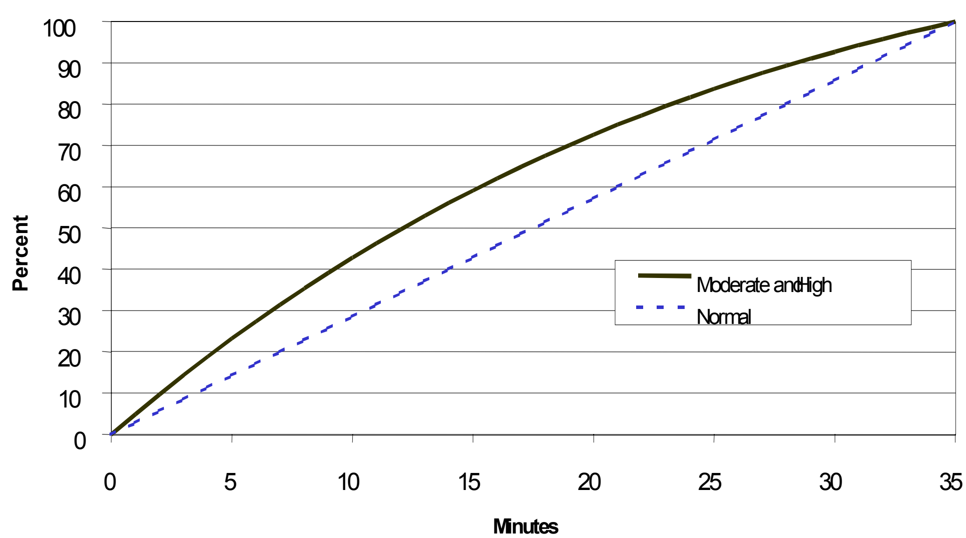


Figure 5.2-A3. Normalized emission profile for normal, moderate, and high

Normalized equation for normal emitters:
$Y(\%) = 2.857*(min)$

Normalized equation for moderate and high
$Y (\%) = 100\%*\{(1.244697*(min) - .020457*(min)^2 + 0.000159*(min)^3 - 0.000000437*(min)^4)/24.666\}$

soak emissions.   Figure 5.2-A3 presents the normalized hot soak emission profile based on 35 minutes, allowing partial hot soaks to be estimated.

Appendix 5.2-A2 Temperature/RVP Database

PROJ	VEH	MY	MAKE	MODEL	VTYPE	FINJ	TEMP	RVP	HS_
0-07	266	93	Dodge	Shadow	LDV	PFI	105	6.2	0.75
0-07	266	93	Dodge	Shadow	LDV	PFI	105	6.9	0.13
0-07	266	93	Dodge	Shadow	LDV	PFI	80	6.2	0.13
0-07	266	93	Dodge	Shadow	LDV	PFI	80	8.9	0.11
0-07	266	93	Dodge	Shadow	LDV	PFI	80	6.8	0.08
0-07	266	93	Dodge	Shadow	LDV	PFI	95	6.8	0.22
0-07	266	93	Dodge	Shadow	LDV	PFI	95	8.8	0.12
0-07	266	93	Dodge	Shadow	LDV	PFI	95	6.2	0.08
0-07	267	91	Chevrolet	Beretta	LDV	PFI	105	8.9	65.50
0-07	267	91	Chevrolet	Beretta	LDV	PFI	105	6.9	34.29
0-07	267	91	Chevrolet	Beretta	LDV	PFI	105	6.3	22.73
0-07	267	91	Chevrolet	Beretta	LDV	PFI	80	8.9	12.12
0-07	267	91	Chevrolet	Beretta	LDV	PFI	80	6.8	10.87
0-07	267	91	Chevrolet	Beretta	LDV	PFI	80	6.2	4.32
0-07	267	91	Chevrolet	Beretta	LDV	PFI	95	8.9	24.43
0-07	267	91	Chevrolet	Beretta	LDV	PFI	95	6.8	13.40
0-07	267	91	Chevrolet	Beretta	LDV	PFI	95	6.2	12.62
0-07	268	91	Ford	Festiva	LDV	PFI	105	9.0	0.36
0-07	268	91	Ford	Festiva	LDV	PFI	105	6.3	0.24
0-07	268	91	Ford	Festiva	LDV	PFI	105	6.9	0.21
0-07	268	91	Ford	Festiva	LDV	PFI	80	6.2	0.17
0-07	268	91	Ford	Festiva	LDV	PFI	80	8.8	0.12
0-07	268	91	Ford	Festiva	LDV	PFI	80	6.8	0.11
0-07	268	91	Ford	Festiva	LDV	PFI	95	9.0	0.31
0-07	268	91	Ford	Festiva	LDV	PFI	95	6.9	0.17
0-07	268	91	Ford	Festiva	LDV	PFI	95	6.1	0.12
0-07	269	94	Hyundai	Excel	LDV	PFI	105	8.9	9.72
0-07	269	94	Hyundai	Excel	LDV	PFI	105	6.8	1.38
0-07	269	94	Hyundai	Excel	LDV	PFI	105	6.2	1.14
0-07	269	94	Hyundai	Excel	LDV	PFI	80	8.6	1.05
0-07	269	94	Hyundai	Excel	LDV	PFI	80	6.1	0.84
0-07	269	94	Hyundai	Excel	LDV	PFI	80	6.7	0.42
0-07	269	94	Hyundai	Excel	LDV	PFI	95	8.7	2.42
0-07	269	94	Hyundai	Excel	LDV	PFI	95	6.2	1.02
0-07	269	94	Hyundai	Excel	LDV	PFI	95	6.7	0.75
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	105	8.8	88.35
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	105	6.3	0.30
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	105	6.8	0.29
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	80	6.7	0.13
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	80	6.2	0.12
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	80	8.7	0.11
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	95	8.7	0.35
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	95	6.8	0.21
0-07	270	94	Chevrolet	Cavalier	LDV	PFI	95	6.2	0.19
0-07	271	91	Dodge	Shadow	LDV	TBI	105	8.8	38.68
0-07	271	91	Dodge	Shadow	LDV	TBI	105	6.8	11.02
0-07	271	91	Dodge	Shadow	LDV	TBI	105	6.1	5.61
0-07	271	91	Dodge	Shadow	LDV	TBI	80	6.5	2.91

0-07	271	91 Dodge	Shadow	LDV	TBI	80	6.2	2.41
0-07	271	91 Dodge	Shadow	LDV	TBI	80	8.8	0.83
0-07	271	91 Dodge	Shadow	LDV	TBI	95	8.7	20.53
0-07	271	91 Dodge	Shadow	LDV	TBI	95	6.7	7.28
0-07	271	91 Dodge	Shadow	LDV	TBI	95	6.2	4.39
0-11	372	88 Jeep	Cherokee	LDT	PFI	106	9.0	12.04
0-11	372	88 Jeep	Cherokee	LDT	PFI	106	6.3	1.07
0-11	372	88 Jeep	Cherokee	LDT	PFI	84	8.9	0.65
0-11	372	88 Jeep	Cherokee	LDT	PFI	96	8.9	1.74
0-11	372	88 Jeep	Cherokee	LDT	PFI	96	6.3	0.56
0-11	375	88 Ford	Ranger XLT	LDT	PFI	106	6.3	6.04
0-11	375	88 Ford	Ranger XLT	LDT	PFI	84	9.0	4.40
0-11	375	88 Ford	Ranger XLT	LDT	PFI	96	9.0	10.73
0-11	375	88 Ford	Ranger XLT	LDT	PFI	96	6.3	2.18
0-11	376	89 Ford	Aerostar	LDT	PFI	106	6.2	10.50
0-11	376	89 Ford	Aerostar	LDT	PFI	84	8.9	19.23
0-11	376	89 Ford	Aerostar	LDT	PFI	96	8.7	30.47
0-11	376	89 Ford	Aerostar	LDT	PFI	96	6.3	11.78
0-11	378	93 Chevrolet	Lumina APV	LDT	TBI	106	8.9	0.97
0-11	378	93 Chevrolet	Lumina APV	LDT	TBI	84	8.9	0.77
0-11	378	93 Chevrolet	Lumina APV	LDT	TBI	96	8.9	0.99
0-11	378	93 Chevrolet	Lumina APV	LDT	TBI	96	6.3	0.89
0-11	379	93 Chevrolet	S-10 Pickup	LDT	TBI	106	6.3	0.41
0-11	379	93 Chevrolet	S-10 Pickup	LDT	TBI	84	8.9	0.32
0-11	379	93 Chevrolet	S-10 Pickup	LDT	TBI	96	6.3	0.40
0-11	380	87 Chevrolet	Blazer 4x4	LDT	TBI	106	6.3	1.22
0-11	380	87 Chevrolet	Blazer 4x4	LDT	TBI	84	8.9	0.69
0-11	380	87 Chevrolet	Blazer 4x4	LDT	TBI	96	8.9	1.55
0-11	380	87 Chevrolet	Blazer 4x4	LDT	TBI	96	6.3	0.31
0-11	381	93 Mazda	B2600i	LDT	PFI	106	6.3	0.29
0-11	381	93 Mazda	B2600i	LDT	PFI	84	8.9	3.94
0-11	381	93 Mazda	B2600i	LDT	PFI	96	6.1	0.28
0-11	381	93 Mazda	B2600i	LDT	PFI	96	8.9	0.17
0-11	384	88 Chevrolet	S-10 Pickup	LDT	TBI	106	6.3	0.52
0-11	384	88 Chevrolet	S-10 Pickup	LDT	TBI	84	8.9	0.19
0-11	384	88 Chevrolet	S-10 Pickup	LDT	TBI	96	8.9	0.46
0-11	384	88 Chevrolet	S-10	LDT	TBI	96	6.3	0.21

			Pickup					
PHOE	5030	88 MAZDA	MX-6	LDV	PFI	105	9.0	33.26
PHOE	5030	88 MAZDA	MX-6	LDV	PFI	95	9.0	0.84
PHOE	5030	88 MAZDA	MX-6	LDV	PFI	80	9.0	0.33
PHOE	5030	88 MAZDA	MX-6	LDV	PFI	105	6.9	6.58
PHOE	5030	88 MAZDA	MX-6	LDV	PFI	95	6.9	1.05
PHOE	5030	88 MAZDA	MX-6	LDV	PFI	80	6.9	0.25
PHOE	5032	91 HONDA	CIVI	LDV	PFI	105	9.0	0.18
PHOE	5032	91 HONDA	CIVI	LDV	PFI	95	9.0	0.07
PHOE	5032	91 HONDA	CIVI	LDV	PFI	80	9.0	0.08
PHOE	5032	91 HONDA	CIVI	LDV	PFI	105	6.9	0.18
PHOE	5032	91 HONDA	CIVI	LDV	PFI	95	6.9	0.18
PHOE	5032	91 HONDA	CIVI	LDV	PFI	80	6.9	0.07
PHOE	5034	85 HONDA	PREL	LDV	NO	105	9.0	41.47
PHOE	5034	85 HONDA	PREL	LDV	NO	95	9.0	19.62
PHOE	5034	85 HONDA	PREL	LDV	NO	80	9.0	7.60
PHOE	5034	85 HONDA	PREL	LDV	NO	105	6.9	8.29
PHOE	5034	85 HONDA	PREL	LDV	NO	105	6.9	8.30
PHOE	5034	85 HONDA	PREL	LDV	NO	95	6.9	8.12
PHOE	5034	85 HONDA	PREL	LDV	NO	80	6.9	4.43
PHOE	5035	90 TOYOTA	CORO	LDV	PFI	105	9.0	48.86
PHOE	5035	90 TOYOTA	CORO	LDV	PFI	95	9.0	11.49
PHOE	5035	90 TOYOTA	CORO	LDV	PFI	80	9.0	5.92
PHOE	5035	90 TOYOTA	CORO	LDV	PFI	105	6.9	25.93
PHOE	5035	90 TOYOTA	CORO	LDV	PFI	95	6.9	6.80
PHOE	5035	90 TOYOTA	CORO	LDV	PFI	80	6.9	2.21
PHOE	5036	86 MAZDA	323	LDV	PFI	105	9.0	17.55
PHOE	5036	86 MAZDA	323	LDV	PFI	95	9.0	25.47
PHOE	5036	86 MAZDA	323	LDV	PFI	80	9.0	2.72
PHOE	5036	86 MAZDA	323	LDV	PFI	105	6.9	14.34
PHOE	5036	86 MAZDA	323	LDV	PFI	95	6.9	2.18
PHOE	5037	89 GMC	CELE	LDV	TBI	105	9.0	13.22
PHOE	5037	89 GMC	CELE	LDV	TBI	95	9.0	5.92
PHOE	5037	89 GMC	CELE	LDV	TBI	80	9.0	0.72
PHOE	5037	89 GMC	CELE	LDV	TBI	105	6.9	4.98
PHOE	5037	89 GMC	CELE	LDV	TBI	95	6.9	0.43
PHOE	5037	89 GMC	CELE	LDV	TBI	80	6.9	0.38
PHOE	5038	92 TOYOTA	CORO	LDV	PFI	105	9.0	7.39
PHOE	5038	92 TOYOTA	CORO	LDV	PFI	95	9.0	0.30
PHOE	5038	92 TOYOTA	CORO	LDV	PFI	80	9.0	0.15
PHOE	5038	92 TOYOTA	CORO	LDV	PFI	105	6.9	0.33
PHOE	5038	92 TOYOTA	CORO	LDV	PFI	95	6.9	0.23
PHOE	5039	86 OLDSMOBIL	DELT	LDV	PFI	105	9.0	14.85
PHOE	5039	86 OLDSMOBIL	DELT	LDV	PFI	95	9.0	6.86
PHOE	5039	86 OLDSMOBIL	DELT	LDV	PFI	80	9.0	2.91
PHOE	5039	86 OLDSMOBIL	DELT	LDV	PFI	105	6.9	15.68
PHOE	5039	86 OLDSMOBIL	DELT	LDV	PFI	95	6.9	1.89
PHOE	5039	86 OLDSMOBIL	DELT	LDV	PFI	80	6.9	1.21
PHOE	5040	90 CHEVROLET	CELE	LDV	PFI	105	9.0	34.10
PHOE	5040	90 CHEVROLET	CELE	LDV	PFI	95	9.0	23.73
PHOE	5040	90 CHEVROLET	CELE	LDV	PFI	80	9.0	0.34
PHOE	5040	90 CHEVROLET	CELE	LDV	PFI	105	6.9	11.94
PHOE	5040	90 CHEVROLET	CELE	LDV	PFI	95	6.9	12.92

PHOE	5040	90	CHEVROLET	CELE	LDV	PFI	80	6.9	0.23
PHOE	5041	86	LINCOLN	LINC	LDV	PFI	105	9.0	0.69
PHOE	5041	86	LINCOLN	LINC	LDV	PFI	95	9.0	0.35
PHOE	5041	86	LINCOLN	LINC	LDV	PFI	80	9.0	0.14
PHOE	5041	86	LINCOLN	LINC	LDV	PFI	105	6.9	0.29
PHOE	5041	86	LINCOLN	LINC	LDV	PFI	95	6.9	0.15
PHOE	5041	86	LINCOLN	LINC	LDV	PFI	80	6.9	0.08
PHOE	5042	87	MAZDA	323	LDV	PFI	105	9.0	14.95
PHOE	5042	87	MAZDA	323	LDV	PFI	95	9.0	7.24
PHOE	5042	87	MAZDA	323	LDV	PFI	80	9.0	0.17
PHOE	5042	87	MAZDA	323	LDV	PFI	105	6.9	0.75
PHOE	5042	87	MAZDA	323	LDV	PFI	95	6.9	2.42
PHOE	5042	87	MAZDA	323	LDV	PFI	80	6.9	0.15
PHOE	5043	89	MAZDA	323	LDV	PFI	105	9.0	9.19
PHOE	5043	89	MAZDA	323	LDV	PFI	95	9.0	0.74
PHOE	5043	89	MAZDA	323	LDV	PFI	80	9.0	0.19
PHOE	5043	89	MAZDA	323	LDV	PFI	105	6.9	6.93
PHOE	5043	89	MAZDA	323	LDV	PFI	95	6.9	0.34
PHOE	5043	89	MAZDA	323	LDV	PFI	80	6.9	0.09
PHOE	5044	93	DODGE	DYNA	LDV	PFI	105	9.0	16.86
PHOE	5044	93	DODGE	DYNA	LDV	PFI	95	9.0	20.63
PHOE	5044	93	DODGE	DYNA	LDV	PFI	80	9.0	0.19
PHOE	5044	93	DODGE	DYNA	LDV	PFI	105	6.9	0.14
PHOE	5044	93	DODGE	DYNA	LDV	PFI	95	6.9	0.18
PHOE	5044	93	DODGE	DYNA	LDV	PFI	80	6.9	0.11
PHOE	5045	90	HONDA	CIVI	LDV	TBI	105	9.0	41.40
PHOE	5045	90	HONDA	CIVI	LDV	TBI	95	9.0	13.59
PHOE	5045	90	HONDA	CIVI	LDV	TBI	80	9.0	0.15
PHOE	5045	90	HONDA	CIVI	LDV	TBI	105	6.9	0.37
PHOE	5045	90	HONDA	CIVI	LDV	TBI	95	6.9	0.26
PHOE	5045	90	HONDA	CIVI	LDV	TBI	80	6.9	0.12
PHOE	5047	91	TOYOTA	TERC	LDV	PFI	105	9.0	0.30
PHOE	5047	91	TOYOTA	TERC	LDV	PFI	95	9.0	0.56
PHOE	5047	91	TOYOTA	TERC	LDV	PFI	80	9.0	0.12
PHOE	5047	91	TOYOTA	TERC	LDV	PFI	105	6.9	0.43
PHOE	5047	91	TOYOTA	TERC	LDV	PFI	95	6.9	0.24
PHOE	5047	91	TOYOTA	TERC	LDV	PFI	80	6.9	0.15
PHOE	5049	87	PONTIAC	GRAN	LDV	TBI	105	9.0	20.63
PHOE	5049	87	PONTIAC	GRAN	LDV	TBI	95	9.0	9.51
PHOE	5049	87	PONTIAC	GRAN	LDV	TBI	80	9.0	2.32
PHOE	5049	87	PONTIAC	GRAN	LDV	TBI	105	6.9	3.66
PHOE	5049	87	PONTIAC	GRAN	LDV	TBI	95	6.9	1.85
PHOE	5049	87	PONTIAC	GRAN	LDV	TBI	80	6.9	0.41
PHOE	5050	89	PONTIAC	6000	LDV	TBI	105	9.0	8.85
PHOE	5050	89	PONTIAC	6000	LDV	TBI	95	9.0	15.32
PHOE	5050	89	PONTIAC	6000	LDV	TBI	80	9.0	0.18
PHOE	5050	89	PONTIAC	6000	LDV	TBI	105	6.9	7.97
PHOE	5050	89	PONTIAC	6000	LDV	TBI	95	6.9	0.32
PHOE	5050	89	PONTIAC	6000	LDV	TBI	80	6.9	0.28
PHOE	5051	88	CHEVROLET	CAVA	LDV	TBI	105	9.0	4.95
PHOE	5051	88	CHEVROLET	CAVA	LDV	TBI	95	9.0	0.48
PHOE	5051	88	CHEVROLET	CAVA	LDV	TBI	80	9.0	0.26
PHOE	5051	88	CHEVROLET	CAVA	LDV	TBI	105	6.9	0.52

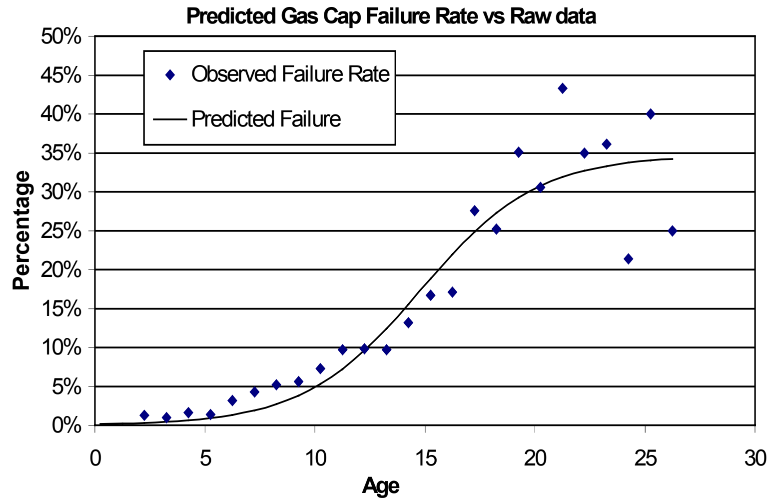
PHOE	5051	88	CHEVROLET	CAVA	LDV	TBI	95	6.9	0.45
PHOE	5051	88	CHEVROLET	CAVA	LDV	TBI	80	6.9	0.36
PHOE	5052	92	SATURN	SATU	LDV	PFI	105	9.0	1.44
PHOE	5052	92	SATURN	SATU	LDV	PFI	95	9.0	0.77
PHOE	5052	92	SATURN	SATU	LDV	PFI	80	9.0	0.54
PHOE	5052	92	SATURN	SATU	LDV	PFI	105	6.9	1.60
PHOE	5052	92	SATURN	SATU	LDV	PFI	95	6.9	1.32
PHOE	5052	92	SATURN	SATU	LDV	PFI	80	6.9	1.19
PHOE	5054	86	BUICK	SOME	LDV	TBI	105	9.0	16.82
PHOE	5054	86	BUICK	SOME	LDV	TBI	95	9.0	2.01
PHOE	5054	86	BUICK	SOME	LDV	TBI	80	9.0	1.05
PHOE	5054	86	BUICK	SOME	LDV	TBI	105	6.9	2.63
PHOE	5054	86	BUICK	SOME	LDV	TBI	95	6.9	1.37
PHOE	5054	86	BUICK	SOME	LDV	TBI	80	6.9	0.84
PHOE	5055	89	BUICK	RIVI	LDV	PFI	105	9.0	56.43
PHOE	5055	89	BUICK	RIVI	LDV	PFI	95	9.0	11.91
PHOE	5055	89	BUICK	RIVI	LDV	PFI	80	9.0	2.56
PHOE	5055	89	BUICK	RIVI	LDV	PFI	105	6.9	6.97
PHOE	5057	81	PONTIAC	LEMA	LDV	NO	105	9.0	34.94
PHOE	5057	81	PONTIAC	LEMA	LDV	NO	95	9.0	17.90
PHOE	5057	81	PONTIAC	LEMA	LDV	NO	80	9.0	11.57
PHOE	5057	81	PONTIAC	LEMA	LDV	NO	95	6.9	11.85
PHOE	5057	81	PONTIAC	LEMA	LDV	NO	80	6.9	9.05
PHOE	5057	81	PONTIAC	LEMA	LDV	NO	105	6.9	15.18
PHOE	5058	81	CHEVROLET	MONT	LDV	NO	105	9.0	60.82
PHOE	5058	81	CHEVROLET	MONT	LDV	NO	95	9.0	25.55
PHOE	5058	81	CHEVROLET	MONT	LDV	NO	80	9.0	15.81
PHOE	5058	81	CHEVROLET	MONT	LDV	NO	105	6.9	21.02
PHOE	5058	81	CHEVROLET	MONT	LDV	NO	80	6.9	17.25
PHOE	5058	81	CHEVROLET	MONT	LDV	NO	95	6.9	17.25
PHOE	5061	79	CHEVROLET	CAPR	LDV	NO	105	9.0	13.78
PHOE	5061	79	CHEVROLET	CAPR	LDV	NO	95	9.0	15.53
PHOE	5061	79	CHEVROLET	CAPR	LDV	NO	80	9.0	11.03
PHOE	5061	79	CHEVROLET	CAPR	LDV	NO	105	6.9	10.63
PHOE	5061	79	CHEVROLET	CAPR	LDV	NO	95	6.9	6.82
PHOE	5061	79	CHEVROLET	CAPR	LDV	NO	80	6.9	7.58
PHOE	5066	93	DODGE	SHAD	LDV	TBI	105	9.0	88.07
PHOE	5066	93	DODGE	SHAD	LDV	TBI	95	9.0	88.07
PHOE	5066	93	DODGE	SHAD	LDV	TBI	80	9.0	0.10
PHOE	5066	93	DODGE	SHAD	LDV	TBI	105	6.9	0.13
PHOE	5066	93	DODGE	SHAD	LDV	TBI	95	6.9	0.22
PHOE	5066	93	DODGE	SHAD	LDV	TBI	80	6.9	0.08
PHOE	5066	93	DODGE	SHAD	LDV	TBI	105	6.3	0.75
PHOE	5066	93	DODGE	SHAD	LDV	TBI	95	6.3	0.08
PHOE	5066	93	DODGE	SHAD	LDV	TBI	80	6.3	0.09
PHOE	5067	91	CHEVROLET	BERE	LDV	PFI	105	9.0	65.13
PHOE	5067	91	CHEVROLET	BERE	LDV	PFI	95	9.0	24.28
PHOE	5067	91	CHEVROLET	BERE	LDV	PFI	80	9.0	12.09
PHOE	5067	91	CHEVROLET	BERE	LDV	PFI	105	6.9	34.12
PHOE	5067	91	CHEVROLET	BERE	LDV	PFI	95	6.9	13.33
PHOE	5067	91	CHEVROLET	BERE	LDV	PFI	80	6.9	10.83
PHOE	5067	91	CHEVROLET	BERE	LDV	PFI	105	6.3	22.62
PHOE	5067	91	CHEVROLET	BERE	LDV	PFI	95	6.3	12.55

PHOE	5067	91 CHEVROLET	BERE	LDV	PFI	80	6.3	4.30
PHOE	5068	91 FORD	FEST	LDV	PFI	105	9.0	0.25
PHOE	5068	91 FORD	FEST	LDV	PFI	95	9.0	0.31
PHOE	5068	91 FORD	FEST	LDV	PFI	80	9.0	0.12
PHOE	5068	91 FORD	FEST	LDV	PFI	105	6.9	0.21
PHOE	5068	91 FORD	FEST	LDV	PFI	95	6.9	0.17
PHOE	5068	91 FORD	FEST	LDV	PFI	80	6.9	0.11
PHOE	5068	91 FORD	FEST	LDV	PFI	105	6.3	0.24
PHOE	5068	91 FORD	FEST	LDV	PFI	95	6.3	0.12
PHOE	5068	91 FORD	FEST	LDV	PFI	80	6.3	0.17
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	105	9.0	9.66
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	95	9.0	2.41
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	80	9.0	1.05
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	105	6.9	1.37
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	95	6.9	0.74
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	80	6.9	0.42
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	105	6.3	1.13
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	95	6.3	1.01
PHOE	5069	94 HYUNDAI	EXCE	LDV	PFI	80	6.3	0.84
PHOE	5071	91 DODGE	SHAD	LDV	TBI	105	9.0	38.48
PHOE	5071	91 DODGE	SHAD	LDV	TBI	95	9.0	20.41
PHOE	5071	91 DODGE	SHAD	LDV	TBI	80	9.0	8.29
PHOE	5071	91 DODGE	SHAD	LDV	TBI	105	6.9	10.97
PHOE	5071	91 DODGE	SHAD	LDV	TBI	95	6.9	7.25
PHOE	5071	91 DODGE	SHAD	LDV	TBI	80	6.9	2.89
PHOE	5071	91 DODGE	SHAD	LDV	TBI	105	6.3	5.58
PHOE	5071	91 DODGE	SHAD	LDV	TBI	95	6.3	4.30
PHOE	5071	91 DODGE	SHAD	LDV	TBI	80	6.3	2.39
PHOE	5072	88 JEEP	CHER	LDV	PFI	105	9.0	53.89
PHOE	5072	88 JEEP	CHER	LDV	PFI	95	9.0	1.74
PHOE	5072	88 JEEP	CHER	LDV	PFI	80	9.0	0.64
PHOE	5072	88 JEEP	CHER	LDV	PFI	105	6.3	1.06
PHOE	5072	88 JEEP	CHER	LDV	PFI	95	6.3	0.55
PHOE	5073	84 DODGE	RAM	LDT	NO	95	9.0	8.94
PHOE	5073	84 DODGE	RAM	LDT	NO	80	9.0	13.03
PHOE	5073	84 DODGE	RAM	LDT	NO	105	6.3	13.93
PHOE	5073	84 DODGE	RAM	LDT	NO	95	6.3	10.75
PHOE	5077	80 FORD	RANG	LDT	NO	95	9.0	15.96
PHOE	5077	80 FORD	RANG	LDT	NO	105	6.3	6.12
PHOE	5077	80 FORD	RANG	LDT	NO	95	6.3	6.92
PHOE	5077	80 FORD	RANG	LDT	NO	80	9.0	5.88
PHOE	5079	93 CHEVROLET	PICK	LDT	TBI	95	9.0	0.40
PHOE	5079	93 CHEVROLET	PICK	LDT	TBI	80	9.0	0.32
PHOE	5079	93 CHEVROLET	PICK	LDT	TBI	105	6.3	0.41
PHOE	5079	93 CHEVROLET	PICK	LDT	TBI	95	6.3	0.40
SBEN	5003	85 BUICK	PARK	LDV	PFI	105	9.0	14.64
SBEN	5003	85 BUICK	PARK	LDV	PFI	95	9.0	17.45
SBEN	5003	85 BUICK	PARK	LDV	PFI	80	9.0	9.65
SBEN	5003	85 BUICK	PARK	LDV	PFI	105	6.9	13.15
SBEN	5003	85 BUICK	PARK	LDV	PFI	95	6.9	8.51
SBEN	5003	85 BUICK	PARK	LDV	PFI	80	6.9	5.87
SBEN	5009	85 TOYOTA	SUPE	LDV	PFI	105	9.0	1.13
SBEN	5009	85 TOYOTA	SUPE	LDV	PFI	95	9.0	1.25

SBEN	5009	85 TOYOTA	SUPE	LDV	PFI	80	9.0	1.08
SBEN	5009	85 TOYOTA	SUPE	LDV	PFI	105	6.9	0.65
SBEN	5009	85 TOYOTA	SUPE	LDV	PFI	95	6.9	1.34
SBEN	5009	85 TOYOTA	SUPE	LDV	PFI	80	6.9	0.26
SBEN	5010	85 FORD	TEMP	LDV	TBI	105	9.0	3.55
SBEN	5010	85 FORD	TEMP	LDV	TBI	95	9.0	0.40
SBEN	5010	85 FORD	TEMP	LDV	TBI	80	9.0	0.95
SBEN	5010	85 FORD	TEMP	LDV	TBI	105	6.9	0.48
SBEN	5010	85 FORD	TEMP	LDV	TBI	95	6.9	0.56
SBEN	5010	85 FORD	TEMP	LDV	TBI	80	6.9	0.36
SBEN	5012	87 FORD	TAUR	LDV	PFI	105	9.0	2.43
SBEN	5012	87 FORD	TAUR	LDV	PFI	95	9.0	1.79
SBEN	5012	87 FORD	TAUR	LDV	PFI	80	9.0	3.92
SBEN	5012	87 FORD	TAUR	LDV	PFI	105	6.9	5.51
SBEN	5012	87 FORD	TAUR	LDV	PFI	95	6.9	3.73
SBEN	5012	87 FORD	TAUR	LDV	PFI	80	6.9	3.72
SBEN	5013	89 CHEVROLET	ASTR	LDT	TBI	105	9.0	1.02
SBEN	5013	89 CHEVROLET	ASTR	LDT	TBI	95	9.0	0.69
SBEN	5013	89 CHEVROLET	ASTR	LDT	TBI	80	9.0	0.31
SBEN	5013	89 CHEVROLET	ASTR	LDT	TBI	105	6.9	0.64
SBEN	5013	89 CHEVROLET	ASTR	LDT	TBI	95	6.9	0.41
SBEN	5013	89 CHEVROLET	ASTR	LDT	TBI	80	6.9	0.48
SBEN	5014	85 NISSAN	300	LDV	PFI	105	9.0	5.89
SBEN	5014	85 NISSAN	300	LDV	PFI	95	9.0	3.17
SBEN	5014	85 NISSAN	300	LDV	PFI	80	9.0	4.45
SBEN	5014	85 NISSAN	300	LDV	PFI	105	6.9	4.85
SBEN	5014	85 NISSAN	300	LDV	PFI	95	6.9	5.58
SBEN	5014	85 NISSAN	300	LDV	PFI	80	6.9	1.38
SBEN	5015	85 NISSAN	300	LDV	PFI	105	9.0	1.28
SBEN	5015	85 NISSAN	300	LDV	PFI	95	9.0	0.91
SBEN	5015	85 NISSAN	300	LDV	PFI	80	9.0	0.92
SBEN	5015	85 NISSAN	300	LDV	PFI	105	6.9	0.93
SBEN	5015	85 NISSAN	300	LDV	PFI	95	6.9	0.88
SBEN	5015	85 NISSAN	300	LDV	PFI	80	6.9	0.56
SBEN	5016	87 VOLVO	740	LDV	PFI	105	9.0	1.35
SBEN	5016	87 VOLVO	740	LDV	PFI	95	9.0	0.96
SBEN	5016	87 VOLVO	740	LDV	PFI	80	9.0	0.74
SBEN	5016	87 VOLVO	740	LDV	PFI	105	6.9	1.11
SBEN	5016	87 VOLVO	740	LDV	PFI	95	6.9	0.77
SBEN	5016	87 VOLVO	740	LDV	PFI	80	6.9	0.63

Appendix 5.2-4. Estimation of the gas cap failure rate from BAR's smog check data performed in Spring 1996.

MY	Age	Observed Failure Rate	Predicted Failure
70	26.25	25.0%	34.2%
71	25.25	40.0%	34.0%
72	24.25	21.4%	33.7%
73	23.25	36.1%	33.3%
74	22.25	35.0%	32.7%
75	21.25	43.3%	31.9%
76	20.25	30.6%	30.7%
77	19.25	35.1%	29.2%
78	18.25	25.2%	27.3%
79	17.25	27.6%	24.8%
80	16.25	17.1%	22.0%
81	15.25	16.7%	18.8%
82	14.25	13.2%	15.6%
83	13.25	9.7%	12.4%
84	12.25	9.8%	9.6%
85	11.25	9.7%	7.2%
86	10.25	7.3%	5.3%
87	9.25	5.6%	3.8%
88	8.25	5.2%	2.7%
89	7.25	4.3%	1.9%
90	6.25	3.2%	1.3%
91	5.25	1.4%	0.9%
92	4.25	1.6%	0.6%
93	3.25	1.0%	0.4%
94	2.25	1.3%	0.3%
95	1.25	na	0.2%
96	0.25	na	0.1%



Parameter	Value
K	0.347
No	0.0013
R	0.3758

Model
Y(%) = K/(1+((K-No)/No)*EXP(-R*AGE))

Note that the incremental gas cap failure rate is defined as the difference between gas cap failure percentage between two consecutive ages.